

An Experimental Study on Evaluating Glare in Blue Light Exposure

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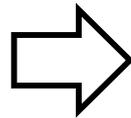
Introduction

- How to improve **work performance** in an office
 - by controlling indoor environment

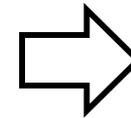


temperature,
air flow, lighting

Control
**indoor
environment**



Improve
arousal

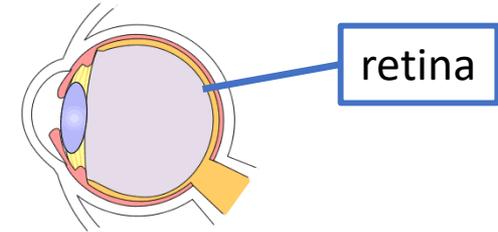


Improve
**work
performance**

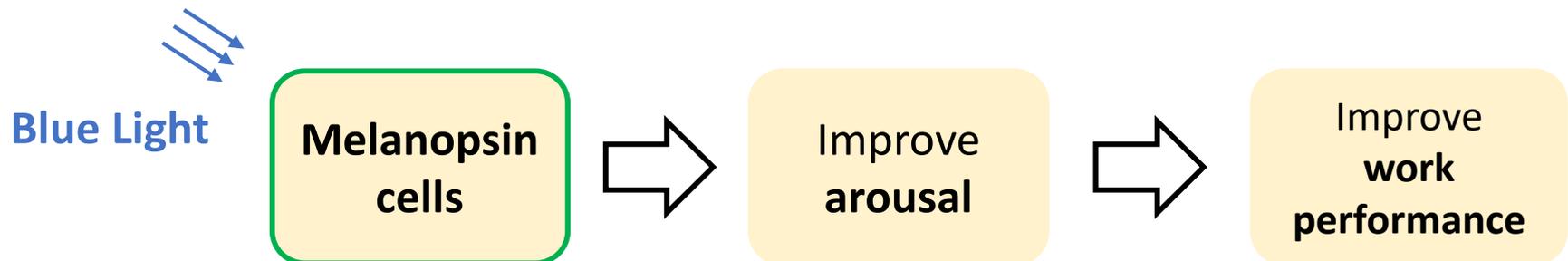


- Exposure to **blue light** improves **human arousal**

Blue Light



- Photoreceptors in the retina called **melanopsin cells***
 - improve human **arousal** when stimulated
 - have spectral sensitivity peaks around the wavelength of **480nm**



*Provencio, I., Jiang, G., Grip, W., Hayes, W., Rollag, D.: Melanopsin: An opsin in melanophores, brain and eye. In: PNAS, Vol. 95, No. 1, pp. 340-345 (1998)

Previous Study*



- An experiment was conducted
 - to evaluate the **intellectual concentration improvement** effect by **blue light exposure**
- As the result,
 - the feeling of **dazzling** disturbs intellectual work



*Miyazaki, D., Ueda, K., Kawamoto, S., Takekawa, W., Ishii, H., Shimoda, H., Yabuki, J., Uchida, T., Noguchi, H.: An Experimental Study on Intelligent Concentration Improvement by Blue Light Exposure. In: Proc., Human Interface Symposium 2018 (2018) (In Japanese)

Purpose of this Study

- to find which **blue light conditions** cause feeling of **dazzling** or **disturb** intellectual work
 - four blue light conditions (shown in next slide)
 - changing **Luminance** and **Light emitting area**



Light Conditions in the Experiment

- Total amount of blue light is the same in all conditions



(a) **1 unit 100% luminance output**



(b) **2 units 50% luminance output**



(c) **4 units 25% luminance output**



(d) **8 units 12.5% luminance output**

Cognitive Task

- Comparison Task



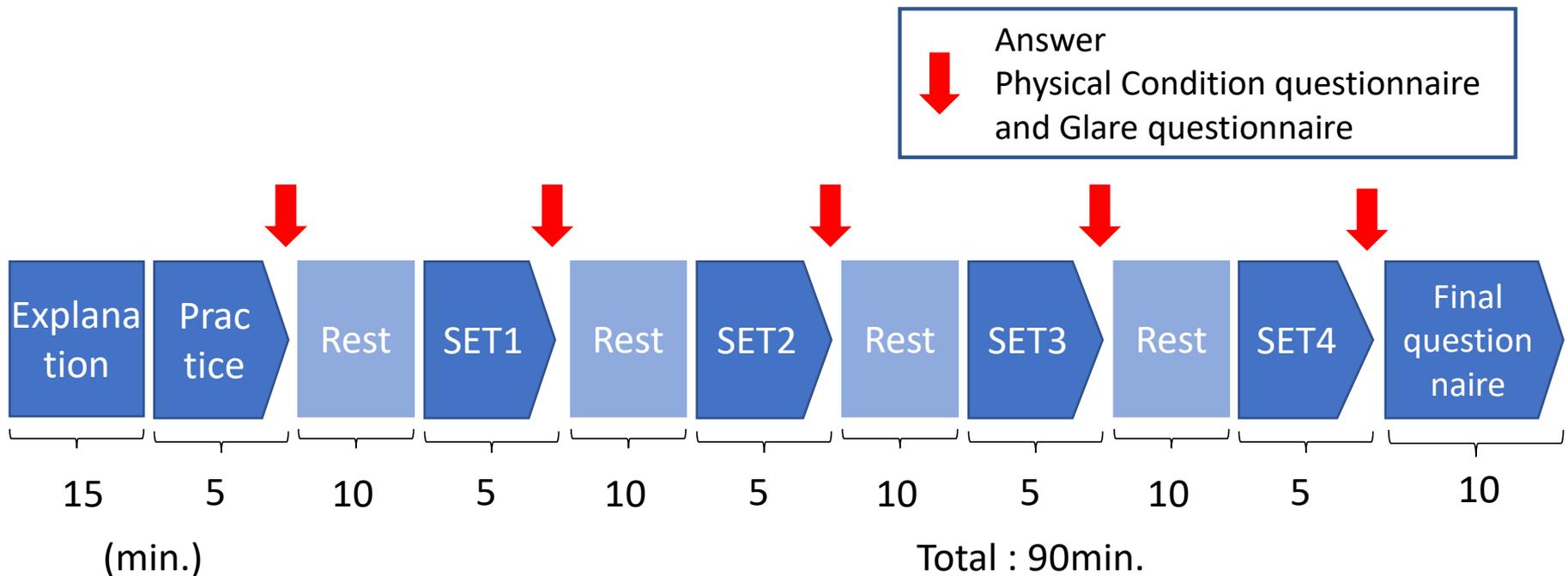
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Procedure of Experiment

- 25 university students
 - males from 19 to 26 ages with normal eye sight



Questionnaire

- Physical Condition questionnaire
 - subjective fatigue, arousal, concentration with 100 grades
- Glare questionnaire
 - subjective dazzling of each light condition with 9 grades (shown in next slide)
- Final questionnaire (choice and free description)
 - which conditions were distractive
 - which conditions were not acceptable

Glare Questionnaire*

- Circle one number to answer

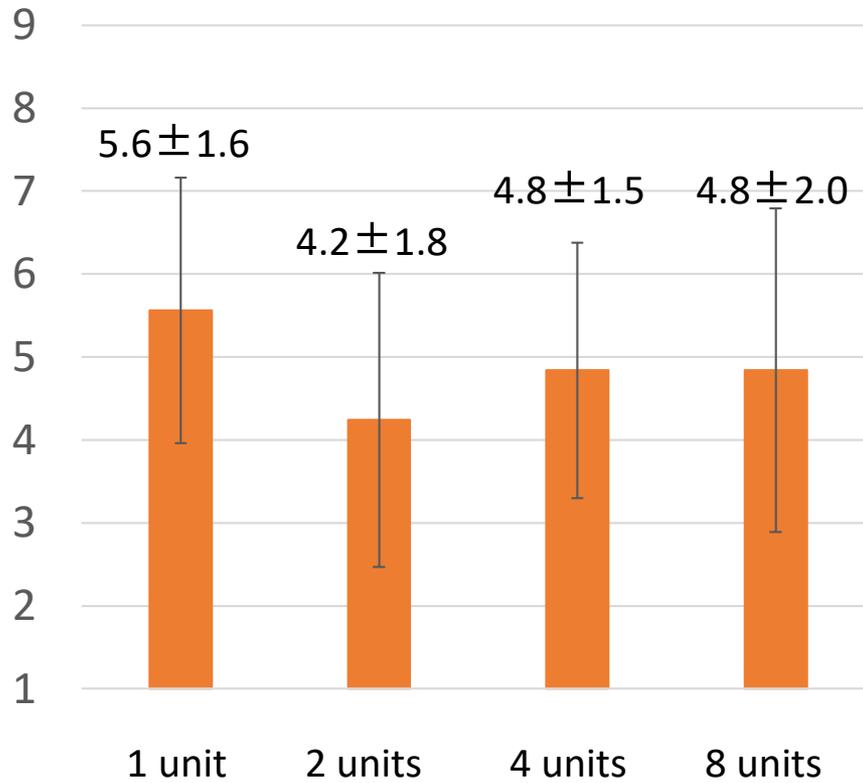
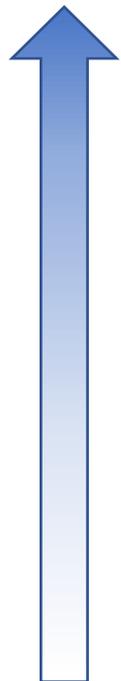
9	—	Intolerable
8	—	
7	—	Uncomfortable but not intolerable
6	—	
5	—	Unacceptable but not uncomfortable
4	—	
3	—	Perceptible but not unacceptable
2	—	
1	—	Imperceptible

*BGI(British Daylight Glare Index): Technical Report No. 10, IES-London, 1967.

Result of Glare Questionnaire

blue light conditions

Dazzling



(a) 1 unit



(b) 2 units



(c) 4 units



(d) 8 units

Result of Final Questionnaire

	Distractive			
	1 unit	2 units	4 units	8 units
the number of answers	17	10	8	8



asymmetry

	Intolerable			
	1 unit	2 units	4 units	8 units
the number of answers	11	3	6	8

because light emitting area was large

because intense light was exposed asymmetrically

Conclusion

- Measured the subjective evaluation of glare
- As the result, 3 factors cause feeling of **dazzling**
 - Luminance
 - Asymmetric irradiation
 - Light emitting area
- In the four light conditions,
 - 2 units condition is the best in the point of **glare**

